

## **Completion Confidence Measurement Tractatus (CCMT)**

by

Edward J. (Ed) Fern, MS, PMP and Mojtaba (Moj) Zarei-Kesheh

On November 9, 2010, a Boeing 787 Dreamliner test plane made an emergency landing in Laredo, Texas when the flight crew detected smoke in the passenger compartment. The airplane was originally scheduled to enter service in May of 2008. Currently Boeing officials are quiet about how the incident will affect the 787's delivery schedule.

“It's tough to make predictions, especially about the future.” – Yogi Berra

This article is a first attempt to define a project progress measurement system that will allow project managers to measure what is not yet known about their projects and to report a reasonable estimate of confidence about whether a project can be completed with its scope requirements satisfied, within an acceptable budget, and within an acceptable time.

---

In 1987, in the United States, there were five competing computerized “repositories” of information about how consumers paid their bills and offering credit reports to credit grantors and others with permissible purposes under United States law. Each of these repositories served some local markets directly and others through affiliated local credit bureaus. Late in 1988, TRW (now Experian) reached an agreement to buy one of its competitors, Chilton Data Services.

At that time, each of the repositories had a proprietary wide area network spanning the United States and through which credit grantors could buy credit reports, either through dial-up points of presence or by way of dedicated cross-domain SNA connections. The agreement to acquire Chilton was undertaken for the purpose of eliminating duplicate costs while retaining most of the revenue. TRW calculated that the result would produce an additional \$5 million in before tax profit each month once the duplicate costs had been eliminated. Based on this calculation, TRW agreed to pay \$375 million for Chilton, the largest acquisition TRW had undertaken at that time. Elimination of the duplicate costs required merger of the data bases and of the wide area networks of the two companies.

As Director of Network Services for TRW, it was Ed Fern's responsibility to oversee the merger of the wide area networks. The overall plan required continued operation of the Chilton Service until midnight, Pacific Standard Time on December 31, 1989, followed two hours later by operation of merged data and networks on January 1, 1990.

The technical staff identified three separate technical solutions to this challenge, each with distinctly different costs but all within the generous capital and expense budgets that TRW executives had allocated for the network merger. The scope and deadline for the project were dictated by management, the cost was of only secondary importance since roughly \$167,000 per day was at stake. Ed next asked the staff which of the three technical solutions could be implemented most quickly. Full work breakdown structures and activity schedules were developed for each solution. Risk identification and resource requirement activities were carried out for each of the solutions. Each of the solutions featured uncertainties that might render them impossible. Each of the solutions featured uncertainties that might require time beyond January 1, 1990.

Ed's solution was to order the schedules for all three solutions to be reconstructed to resolve both the fatal and the delaying uncertainties to be resolved as quickly as possible. He then assigned separate staff to each of the three projects and authorized three projects instead of one.

Within the first three weeks, it was learned that one of the solutions would require delivery of new hardware that the supplier could not deliver in time for us to complete the project by December 31. Ed then cancelled this project and divided its staff between the remaining two projects. The cancelled project had cost only about \$40,000. Was this money wasted?

Sixty days later, it was learned that another of the solutions could be completed on time but would not permit testing of the cut-over procedure in advance of the December 31/January 1 live cut-over. This risk seemed unacceptable so Ed cancelled this project and bet \$167,000 per day of his employer's money and his own career on the remaining technical solution. This cancelled project had cost over \$200,000. Was this money wasted?

In early July, Ed was approached by one of his managers who asked if he was aware that the International Brotherhood of Electrical Workers (IBEW) contract with NYNEX was set to expire on July 31. He had not been aware of this but he was aware that the project schedule called for members of this union to re-terminate circuits within the NYNEX service area during the month of August. The schedule was quickly revised to accommodate duplication of these circuits in July, at an additional expense of \$75,000. The IBEW reached a new contract agreement with NYNEX on July 27 so there was no work stoppage. Was the \$75,000 wasted?

The remaining solution project was completed with more than 90 days remaining for exhaustive testing of the cut-over process. Ed was in the network control center for the cut-over and left for home at 01:00 on January 1, secure in the knowledge that his previous year's work had been successful.

Every project we undertake is burdened with uncertainties. There are things we do not know that will have an impact on the cost of the project, on the time the project will take to complete, and occasionally on our ability to complete the project. Progress is often measured in terms of the percentage of work that has been accomplished. This method encourages us to defer work on the issues that surround our ignorance and uncertainty in order to show the measured progress.

Instead, responsible project managers will follow the lesson taught by their mothers: "Look both ways before crossing the street." They will construct a list of the things they do not yet know, the uncertainties, that are involved in achieving the desired results of their project. They will devise alternative outcomes for these uncertainties and probabilistically estimate the impact of each of the alternatives. Both Boeing and TRW experienced supply chain problems with their projects. TRW anticipated this possibility, Boeing did not. TRW had alternatives in place, Boeing did not.

In November of 2010, Mojtaba Zarei-Kesheh made a presentation at the Earned Value Analysis (EVA) Europe conference in Ghent, Belgium. This presentation is the result of a collaboration between the authors of this article and can be viewed at

<http://www.eva-europe.eu/2010/conf/presentations/files/AC%203.pdf>.

In it, we present the concept of the Completion Confidence Measurement Tractatus (CCMT). This method of measuring progress places emphasis on identifying and estimating the consequences of possible resolutions of project uncertainties in terms of both time and money. Once these estimates are completed, a set of possible outcomes can be calculated and a "worst case" can be identified for cost, for time, and for each of the mandatory scope requirements.

As illustrated in the TRW case, one or both of time and cost may have a "permissible" maximum value, beyond which the project becomes either problematic or impossible. Projects also have both mandatory and optional scope objectives. At TRW, cost was not a major consideration but realizing the merger financial goals dictated a time objective. The scope objectives of connectivity, speed, integrity, and reliability were also mandatory, while cost of operation and adaptability to future development were optional. The Completion Confidence Indices (CCI) are computed by dividing the worst cases for time and cost by the permissible limits imposed on the project, yielding a CCCI for cost, a TCCI for time, and a group of SCCIs for the mandatory scope requirements. The PCCI, for the project, is the worst of the full set. Careful readers will note that our nomenclature has been modified since the Ghent presentation as we have resolved a few more uncertainties.

This methodology encourages the project team to reduce the PCCI to a number less than one as quickly and cost effectively as possible. This focus, in turn, provides the project sponsor with a much earlier view of real project progress and the likelihood of its successful completion.

As a project progresses, uncertainties will be resolved. A few of these resolutions will impact the schedule or cost directly but most resolutions will be in the scope arena. These resolutions will have indirect impact on the time and cost indices. In the worst case, delivery of a mandatory scope requirement will prove to be impossible. In this case, the project must be abandoned, though it may be revisited in the future in the event of a technological breakthrough. Projects may also be abandoned if either the completion time is too long to be acceptable or the cost exceeds available project funding. Resolving uncertainties early saves the sponsoring organization from squandering time and effort on projects that cannot be completed. By comparing PCCIs across a portfolio of projects, the portfolio manager has additional information with which to allocate limited resources.

In the TRW case, the first of the alternatives to be abandoned was a result of a TCCI that could not be reduced to a value less than one. The second alternative was abandoned because the SCCIs would all remain too high because the testing window would be too short. That also impacted the TCCI indirectly. The response to the IBEW/NYNEX was a simple sacrifice of an optional scope objective, i.e., low cost, for the benefit of a mandatory objective, time.

Because we are familiar with existing tools for measuring project success, we find this new idea stressful. We are reluctant to leave behind methods that have served us well through many projects. Completing the formulation of our idea into a usable tool will require a lot of work. Testing the tool, and finding others willing to test the tool, will also require a lot of work. Nevertheless, we also recognize that we might be able to do our jobs better if we had better tools. This idea seems that it just might be the key to a better tool. Of course, the job of developing our idea into a full-blown measurement tool will require us to identify, estimate, and resolve many uncertainties. So, we must ask your patience while we do the work our new project requires.

"Some men see things as they are and ask why - I dream things that never were and ask why not." -  
-- **George Bernard Shaw**

## About the Authors



**Edward J. (Ed) Fern, MS,PMP**

Author



Edward J. Fern, PMP, is president of Time-to-Profit, Inc., a consultancy focused on project management and product development. His career in Information Technology and Product Development began in 1973. He has held director level positions with Sprint, Control Data Corporation, and TRW. He earned an MS in Technology Management from Pepperdine University in 1992 and his Project Management Professional (PMP) designation in 1998. Ed has prepared more than two thousand PMPs in twenty-seven countries on six continents.

Mr. Fern is the author of "Time-to-Profit Project Management: A Primer for Project Managers in Commercial Product Development" and co-author of "Six Steps to the Future: How Mass Customization Is Changing Our World", both published in English, Russian, Romanian and Brazilian Portuguese. Uncertainty Management and Completion Confidence Measurement will be among the subjects of Ed Fern's third book. Edward J. Fern can be reached at [edfern@timetoprofit.com](mailto:edfern@timetoprofit.com).



## **Mojtaba (Moj) Zarei-Kesheh**

Author



Mojtaba Zarei-Kesheh, is the creator of the technique *Integral Earned Schedule (IES)* which integrates time and cost in earned value management (EVM). He is a Project Planner at Network Rail in London with 8 years experience on a number of projects across industries including Railway Systems, Construction, Automotive and Petrochemical projects. He has a BSc in Construction Management with First Class Honours Degree from London South Bank University. He presented and premiered the concept of IES on the subject of "Measuring integral earned schedule (IES) and predicting the project's final completion duration: The application of kinematics approach to earned value management metrics" at the EVA-1 Europe Geneva (Switzerland) CERN Conference 2009. He presented "Predicting Time and Early Warning Signal in Construction Projects with Integral Earned Schedule (IES)" and "Completion Confidence Measurement Tractatus (CCMT) – A Dynamic Method to Measure Project Progress, Monitor and Control Projects Using Uncertainty" at the EVA-2 Europe Ghent (Belgium) Conference 2010. His research interests include EVM, ES, IES, LBMS, CCMT and Time Predicting Techniques.

His expertise are Project Planning, Scheduling and Controlling, Primavera P3/ P6, EVM and ES implementation complying ANSI/EIA 748 and Location-based Management System (LBMS). Mojtaba Zarei-Kesheh can be reached at [Moj.Zareikesheh@gmail.com](mailto:Moj.Zareikesheh@gmail.com).